NOVEMBER 30, 1850.—(STATED MEETING.)

HUMPHREY LLOYD, D. D., PRESIDENT,
in the Chair.

ON the recommendation of Council,

IT WAS RESOLVED,—"That the rule of the Academy limiting the number of Honorary Members to sixty, be not considered as applying to the President and Ex-Presidents of the Royal Society."

The following Gentlemen were elected Honorary Members of the Academy:—*In Science*—Alexander D. Bache, Washington. *In Polite Literature* — Washington Irving, New York; Augustus Boeck, Berlin; Victor Cousin, Paris. *In Antiquities*—L. C. F. Petit-Radel, Paris; and C. T. Grotefend, Hanover.

The President read the following paper on the position of the Isogonal Lines in Ireland, as deduced from the observations of Sir James Ross, in 1838.

"In the year 1835 I laid before the British Association, then assembled in Dublin, a Report on the Direction and Intensity of the Terrestrial Magnetic Force in Ireland, based upon observations made by Lieut.-Colonel Sabine, Sir James C. Ross, and myself.* In these observations Mr. Robert Were Fox and Professor Phillips afterwards took part; and the survey was subsequently extended to the whole of the British Islands. The details of this extended survey are given in a Memoir on the Magnetic Isoclinal and Isodynamic lines in the British Islands, drawn up chiefly by Lieut.-Colonel Sabine. †

"The observations contained in these Reports are limited to the Magnetic Inclination and Intensity. Observations of the Declination, as well as of the other two elements, were

* Fifth Report of the British Association for the Advancement of Science.

† Eighth Report.

indeed made by Sir James Ross; but they have only lately been given to the public in a Memoir by Lieut.-Colonel Sabine, on the lines of Magnetic Declination in the Atlantic.* In this Memoir, the observations referred to are combined with a large mass of other materials, and the position of the isogonal lines inferred from the whole by a graphical process. The Irish portion of these observations is, however, so distinct, and so complete in itself, that it seemed to me desirable that they should be discussed by the same method which had already been applied to the observations of the other two elements, in the Reports above referred to; such a discussion serving to complete the Magnetic Survey, so far as Ireland is concerned, and to furnish a formula for the Magnetic Declination at any point in the island whose position is known.

"The following is the mode of doing this:

"If δ denote the magnetic declination at any place; δ_0 that at some near station which is taken as the origin of co-ordinates; and x and y the actual distances (in geographical miles) between them, measured on the parallel of latitude and on the meridian, respectively,—or the co-ordinates of position of the former station referred to the latter as an origin; the relation of these quantities is expressed approximately by the equation

$$\delta - \delta_0 = Mx + Ny,$$

in which M and N represent the increase of declination corresponding to each geographical mile of distance in the two directions. If λ and μ denote the latitude and longitude of the former station, λ_0 and μ_0 those of the latter,

$$y = \lambda - \lambda_0, \qquad x = (\mu - \mu_0) \cos \lambda.$$

"It is evident, that if x and y be treated as variable, δ being constant, the preceding equation is that of the *locus* of all the points of given declination. It is that of a right line, making the angle with the meridian,

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* Philosophical Transactions, 1849, Part ii.

$$\text{ang.}\left(\text{tang} = -\frac{N}{M}\right);$$

and the increase of declination corresponding to each geographical mile of distance, in a direction perpendicular to this line, is

$$\sqrt{(M^2 + N^2)}.$$

"It is evident then that, to obtain the values of M and N, observation must give the values of the declination at *three*, or more, stations. The observations of Sir James Ross were taken at twelve stations, well distributed throughout the island; and as they were all made during the months of October and November, 1838, no correction is required to reduce them to a common epoch. For convenience of reference, they are here extracted from Colonel Sabine's Memoir, together with the longitudes and latitudes of the places of observation.

STATION.	λ	μ	δ
Valentia, . . .	51° 56′	10° 17′	28° 42′
Killarney, . .	52 2	9 30	28 11
Westport, . .	53 48	9 29	29 9
Limerick, . . .	52 40	8 36	28 3
Cork, ...	51 54	8 28	27 44
Markree, . . .	54 14	8 28	29 15
Shannon Harbour,	53 14	7 53	28 3
Edgeworthstown,	53 42	7 33	28 8
Londonderry, .	54 59	7 19	28 47
Waterford, . .	52 15	7 8	26 44
Armagh, . . .	54 21	6 39	28 8
Dublin, . . .	53 21	6 15	27 35

"Taking Dublin as the origin of co-ordinates, and substituting the values of $\lambda - \lambda_0$, $\mu - \mu_0$, and $\delta - \delta_0$, given by this Table, in the equation above given, we obtain eleven equations of condition, from which the values of M and N are obtained by the method of least squares. They are the following:

$$M = 0'{\cdot}690, \quad N = 0'{\cdot}585.$$

We may now test the accuracy of these numbers, by employing the formula to *calculate* the values of the declination at each of the eleven stations. The result of this calculation gives, at Waterford, a difference between the observed and calculated values amounting to 34′,—which far exceeds the probable error of observation. This difference is, therefore, probably due to some local irregularity of the magnetic force. But, whatever be its cause, it is obvious that it tends to vitiate the general result; and that a nearer approximation to the values of M and N will be obtained by excluding that observation from the computation. We thus obtain, from the remaining ten equations,

$$M = 0'{\cdot}689\,; \quad N = 0'{\cdot}527.$$

And substituting these values, we find

$$\text{ang.}\left(\text{tang} = -\frac{N}{M}\right) = -37°25'; \quad \sqrt{(M^2 + N^2)} = 0'{\cdot}867.$$

Accordingly, the isogonal lines in Ireland lie to the *east* of north, making an angle of 37°25′ with the meridian of Dublin; and the declination increases as we proceed in the north-westerly direction, the increase being 52″ for each geographical mile, in a direction perpendicular to these lines.*

" Finally, the declination at any point of the island, whose longitude and latitude are known, is given by the formula

$$\delta - \delta_0 = 0'{\cdot}527\,(\lambda - \lambda_0) + 0'{\cdot}689\,(\mu - \mu_0)\cos\lambda\,;$$

the declination at Dublin, δ_0, being supposed known. Or, if we substitute for $\cos\lambda$ the value corresponding to the mean latitude ($\lambda = 53°17'$),

$$\delta - \delta_0 = 0'{\cdot}527\,(\lambda - \lambda_0) + 0'{\cdot}412\,(\mu - \mu_0).$$

" The mean declination at Dublin, for the year 1850, is

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* " This result agrees very closely with Colonel Sabine's map of the isogonal lines in the Atlantic, as to the *direction* of the lines; but gives a more rapid rate of increase."

26° 29′ west; and as the yearly value of the secular change of the declination is − 6′·06, the mean declination, in any not very remote future year, will be given by the formula

$$\delta_0 = 26° 29' - 6'·06 \times n;$$

n being the number of years, counted from the present. If greater accuracy be desired, the diurnal and annual variations of the declination, corresponding to the time of the day and of the year, must be added."

The Secretary, on the part of Mr. M. J. Anketell, presented to the Museum of the Academy a man's shoe made of three pieces of thin plate bronze or brass. This shoe, Mr. Anketell states, was found, with about two dozen pair of the same kind, near an old heap of stones in the vicinity of the Giant's Causeway.

"This shoe (A), with another (B) of the same kind, exhibited, was purchased in the year 1831, by Mr. Anketell, from a brazier in Coleraine, who had melted down or worked up all the others found, he not considering them to be of any peculiar value.

"Along with the shoes were found the two small vessels exhibited. They are made apparently of the same materials, but they are differently fabricated, and put together with great care, and are evidently intended for use; while the shoes, on the contrary, are only fastened together so very imperfectly with lead, used as solder, that the least wear, or motion of the foot of a person attempting to walk in them, would break the soles away from the uppers.

"One of the vessels is a cylindrical cup, having the following dimensions, its bottom being slightly convex:

Diameter, ...	1¼ inches.
Depth, ...	3½ „

"This cup is brazed, and the edges of the brass plate, at the